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ABSTRACT

An overview is presented of what research studies have revealed about: instruction in school subjects; general elements of teaching (such as organization and conduct of lessons); prevention and control of misconduct; interpretation of test results; diagnosis of learning difficulties; and the conditions and procedures of learning and development. Teacher performance common to instruction in all subjects (generic performances) have been identified as positively correlated with student outcomes. Researchers have identified, described, and tested the effectiveness of a large number of generic elements in teaching. Concepts of effective teaching have been assembled and classified into six instructional domains: planning, management of student conduct, instructional organization and development, presentation of subject matter, communication, and testing. Another area of research has dealt with content-specific teaching performances and techniques used for instruction in different subject matters. A third component of pedagogical education is theoretical pedagogy, which consists of concepts and principles about human development, conditions of learning, and the relations among social variables. Each of these components is described with summaries of relevant research findings. (JD)

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RESEARCH BASES FOR TEACHER EDUCATION

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Pedagogical research covers instruction in the school subjects; general elements of teaching such as organization and conduct of lessons, prevention and control of misconduct, interpretation of tests results, diagnosis of learning difficulties; and the conditions and procedures of learning and development.

What Teaching Is

In its simplest terms, teaching is the application of treatments, consisting mainly of teacher performances, verbal and nonverbal. In this regard it is like other professions -- engineering, agriculture, medicine, law, and the like -- each of which entails interacting with things, plants, animals, or human beings.

In its early stages each profession is a craft based upon knowledge derived from trial and error and passed on from generation to generation by imitation and informal instruction. In modern terms, as Alfred North Whitehead (1933) told us, a profession is an occupation whose activities are subject to theoretical analysis and scientific study and improvable by knowledge derived therefrom. This knowledge and the process of its discovery characterize a profession and distinguish it from a craft.

To be sure, a profession uses techniques, procedures, and information inherited from its early days. For instance, we know from the wisdom of experience that a student's anger is abated by a sitting posture, just as a physician knows by tradition that a broken bone heals in splints. But these

SP 025 564

early techniques and procedures, which the layman considers obvious and often calls common sense, bulk little in the total knowledge of modern professions.

Research Challenges Traditional Beliefs and Practices

Unfortunately, professions inherit erroneous and harmful treatments as well as beneficial ones. One of the tasks of pedagogical research is to replace faulty and harmful remedies with effective treatments. One of the earliest efforts to challenge pedagogical practices by empirical studies was that of Joseph M. Rice, a New York physician turned pedagogue. After a brief study of pedagogy in Germany, he came home in the late 1880's to make his famous survey of schools after which he began his empirical studies (Rice, 1897, 1903). His first study gave evidence of the effect of time on spelling achievement. Most schools allocated as much as 40 to 50 minutes a day to spelling. His studies showed that where spelling was taught 15 to 20 minutes per day students did just as well on tests as students in schools where spelling was taught for longer periods.

Rice's findings were roundly rejected by many school people and laymen, saying that spelling was taught to discipline the mind. Rice retorted that the purpose of spelling lessons was to learn to spell. It took research and twenty-five years of instruction to purge pedagogy of this notion of discipline. Beliefs live on after their brains have been knocked out, as Charles Sanders Peirce observed. Objections to pedagogical research continue to this day, some complaining that its results are trivial and add nothing to common sense, and others that its methods are fatally flawed.

All of us have a sprinkling of ideas about most professions. Each of us does some teaching just as we do some doctoring and farming. We treat our maladies and urge our remedies upon relatives and friends. Most of us do a bit of gardening, and most of us like to tell our friends how to do it. All of us teach. We explain, define, give directions, relate, and instruct in many ways. Often, too, we have been taught. The residue of these experiences constitute our pedagogical common sense.

What about our common sense? Does it withstand the challenges of pedagogical science? Here are some statements. Which ones do you think are obvious?*

1. The errors that children make, as they try to learn the fundamental processes of arithmetic, are attributable to guessing and lack of attention. When children do not know, they guess.

2. We all know that children will misbehave when they have a chance. They must be controlled. Teachers are too lenient; that is why they have so many discipline problems.

3. If a group of persons is subjected to the same experience, its members will become more uniform in their performance. Students who are given practice in a skill become more alike in that skill.

*These examples were adapted from Dunkin, M. J., and Biddle, B. J. (1974). The Study of Teaching, New York: Holt, Rinehart and Winston, p. 19, and from Gage, N. L., and Berliner, D. C. (1975). Educational Psychology (2nd ed.), Chicago: Rand McNally, p. 16.

4. If you want to teach a person to fire a gun accurately, give him practice in firing a gun.

If you think these statements are obvious, you are wrong. They are all contrary to what we know from research. Studies indicate that

1. childrens' errors in arithmetic tend to run in patterns and that their mistakes are reasonable to them;

2. except for hard core cases, teachers unwittingly incite misconduct by their classroom performance (Kounin, 1970);

3. differences among individuals practicing the same skill increases from trial to trial (Anastasi, 1958);

4. one does not learn a skill simply by practice, because the learner must know the accuracy of his or her trials, and in complex skills, one must know the procedure or principle involved, as in finding the range of the target in learning to hit a moving object (Gagne, 1962).

These scientific facts are an affront to our common sense just as a new medical treatment or agricultural procedure. When penicillin was introduced as a wonder drug, there were a considerable number of "oh my's" heard around the land, for who would have thought bread mold could cure frightful diseases. Certainly the discovery of penicillin was no more shocking to our sense of logicality than the discovery that teachers are the architects of classroom disorders or the fact that practice does not lead to mastery of a skill.

The Content of Pedagogical Education

Pedagogy consists of three components: First, teacher performances common to instruction in all subjects. These are called generic. Second, performances unique to particular subjects of instruction. These are called content-specific. Third, concepts by which to sort out and explain teacher performances and the procedures of learning and development. These are called theoretical. These three components constitute the primary content of pedagogical education.

Generic Teaching Performances

What does research say about these components? Consider first generic performances. A significant breakthrough in the study of teaching was the identification of generic performances positively correlated with student outcomes. Using a process-product approach, researchers have identified, described, and tested the effectiveness of a large number of generic elements of teaching. These findings have recently been summarized in papers presented at the Airlie House Conference, sponsored by the National Institute of Education (Good, 1983), and in papers presented at the 1982 Annual Session of the American Association of Colleges for Teacher Education (Smith, 1983). Perhaps the most exhaustive survey of research on generic teaching behavior is that made at the University of South Florida under the auspicies of the Florida Coalition for the Development of a Performance Measurement System. Using studies whose dependent variables are measures of student outcomes, a set of thirty-one concepts of effective teaching was assembled and classified into six broad domains of instruction: planning,

management of student conduct, instructional organization and development, presentation of subject matter, communication, and testing (Florida DOE, 1984). These thirty-one concepts subsume 124 indicators of teaching behavior, each of which is defined and exemplified by one or more instances of teacher performances. Each concept and its indicators are followed by a summary of supportive studies and by studies that report extensions and exceptions to the concept.

Considering these extensive research reviews, there is little need for another summary. It is appropriate, however, to give the flavor of generic knowledge by a few examples.

Classroom discipline is one of the most feared duties of teachers, especially beginners. Research clearly indicates ways of treating students to prevent disorder and to create a well managed classroom. Here are some treatments. It will appear to most of us immediately that any group must live by rules if it is to have any semblance of order. A number of studies confirm this bit of wisdom (Emmer et al., 1980; Evertson, et al., 1983; Sanford and Evertson, 1981; Greenwood et al., 1974). But research goes on to show that children often do not understand the rules or know how to obey them, even when clearly stated. So, if rules are to be obeyed, the teacher must explain, illustrate, and provide practice in their use. In short, rules must be taught especially at the elementary level.

I remember a classroom in which the teacher kept saying, "Be quiet." For a few moments the students were less noisy, but as the noise grew louder the teacher would again ask for quietness. Finally one student asked, "What

is quiet? I thought we were quiet." The teacher was trapped, for she could not specify quietness any more than you can define a rain -- how many drops make a rain? This teacher's failure is attributable to the fact that she had no definable quietness rule, and no rules to prevent the noisy disorders in the first place.

No less surprising is the discovery that teachers who maintain instructional momentum have fewer student disruptions than teachers who allow the momentum to drag or die, as in a clumsy transition to a new activity (Kounin, 1970). We now know the ways that teachers impede or destory momentum. A teacher can fragment directions or activities and thereby try the patience of students. For example, in directing the class to take up a new activity, such as working on math problems, a teacher can say, "Put away your art work, take out your math books and worksheets, put them on your desks and locate your pencils, be sure your pencils are sharp. We do not want interruptions once we start." This practice is almost certain to incite students to misbehave. Yet teachers who are not trained in classroom management frequently indulge in fragmentation.

All of us know that one of the tricks of helping children control their conduct is to be aware of what they are doing. In the classroom simple awareness is inadequate. A teacher must know not only what is going on but the teacher's behavior must signal to the students that the teacher knows what is going on (Kounin, 1970; Borg and Ascione, 1982; Borg, 1975, 1975a). In other words, students must be aware that the teacher is aware of what they are doing. If disruptions occur, and the teacher desists the wrong

student. the teacher thereby clearly tells the class that she or he is not with-it, even though the teachers is aware of the disruption. A teacher can reveal lack of withitness in a number of ways. For instance, the teacher can allow a deviant behavior to spread by failing to nip it in the bud; or be unskilled in handling two events at once, as when a disruption is not handled while a teacher is attending to a task.

These few samples focus on the prevention of misbehavior. But even in skillfully managed classrooms some deviant behavior will occur. When it happens, it should be handled calmly and objectively. Research indicates that angry and punitive disapproval creates a ripple effect and that students respond with further disruptions (Kounin, 1970; O'Leary et al. 1970).

Another area of teacher performance is that of lesson organization and development. This area is the heart of the teacher's work, for learning is partly a function of the quality of instruction. Extensive research has identified some of the conditions of classroom learning. One important finding is that the amount of time students are involved is positively associated with measures of achievement. If students are involved in tasks that are neither overwhelming nor unchallenging achievement will be higher than in classes where these conditions are absent (Denham and Lieberman, 1980).

It is equally clear that certain procedures are essential to successful lesson development. For example, that teachers focus on academic work (Denham and Lieberman, 1980), and that they recognize and honor student ideas (Rosenshine, 1971; Dunkin and Biddle, 1974). It is also crucial that the teacher provide for reviews at the beginning and end of lessons, and

that these reviews cover the lesson of the day and occasionally the lessons of the preceding week or earlier. According to a number of studies, reviews increase retention as well as learning (Peterson, et al., 1935; Petros and Hoving, 1980; Good and Grouws, 1979).

We are becoming increasingly aware of the significance of classroom communication. A number of studies consistently indicate that skill in verbal discourse can contribute significantly to student achievement (Smith, 1977; Smith and Edmonds 1978; Smith and Cotten, 1980; Land and Smith, 1979). Single and direct questions, rather than multiple and garbled questions, facilitate learning. A teacher who asks three or four questions when a single question is sufficient leaves the students wondering what the teacher has asked and how to respond. Furthermore, teachers who use vague or empty expressions such as "something like that," "the rest," and "sort of" where more exact information is available are less likely to influence learning than teachers who use concise expressions (Hiller, et al., 1971). Also consistent discourse, leading to a point, is more effective than scrambled discourse marked by discontinuity.

Emphasis is also important. Teachers are more effective when they use such techniques as planned repetition of important points, marker expressions such as "note this" or "this is important," or techniques such as underlining, use of colors, and diagrams when presenting information, as on chalkboards, slides, and the like (Pinney, 1969; Petri, 1963; Jersild, 1928).

Although research on voice and body language is in its infancy, preliminary studies indicate that comprehension is favored by a threshold of 150

words per minute (Carver, 1973). Studies also suggest that voice variations are preferred over other voice qualities such as volume, phrasing, and rate (McCoard, 1944; Diehl and McDonald, 1956). In general it can be said that research suggests that effective teachers have significantly better speech than ineffective teachers.

Another area of teaching, one of the most essential for the proper education of anyone, is the teaching of concepts, for concepts are the bricks and mortar of knowledge. With them we interpret the world as it comes through our senses; with them we build rules and laws and understand things and events. The teaching of concepts is thus a top priority at all levels and in all subjects.

Until recently concept teaching was mostly unwitting, for knowledge of how to teach concepts was scarce. Howevr, the last decade has witnessed a number of substantial studies that indicate, among other things, that simply defining a concept is inadequate (Feldman, 1972). In addition, examples and non-examples are essential and a few well chosen examples, say four or five, are better than a large number. Examples are more effective when they differ widely in variable attributes; non examples are more effective if they exhibit few criterial attributes (Tennyson, et al. 1972; Klausmeier, et al., 1976). When the concept is understood it should be distinguished from concepts with which it can be confused, especially if the concept is a member of a family of concepts, as parole is a member of a family and probation and pardon are relatives.

Some concepts, often the most seminal ones, are hypothetical constructs; for example, gene and atom. For these concepts there are no

examples and connection with the observable level of experience is made only by an inference chain. At least a half dozen studies suggest that almost 50 percent of high school students are unable to master these hypothetical concepts under present modes of instruction (Lawson, 1983). Without these concepts students cannot succeed in subjects heavily weighted with these abstractions. Research on how to teach hypothetical concepts is embryonic, but recent studies are promising. They suggest that certain modes of instruction in higher mental processes develop concepts and abstract modes of thinking such as thinking with variates, correlates, and controls (Lawson, 1983).

Studies of generic teaching behavior have been carried on mostly with elementary teachers and intermediate grade students and in the skill subjects of reading and mathematics. For this reason, researchers have repeatedly warned against generalizing the findings to other grades and subjects. However, this advice should be taken cautiously for it appears unlikely that any significant teaching can be done without exercising some of the behaviors just discussed.

Moreover, a recent study provides empirical support for the generality of these behaviors (Florida D.O.E.; 1984a; Peterson, et al., in press). In developing an instrument for the measurement of teacher performance, my colleagues and I condensed the 134 indicators, mentioned above, to 39 which became the items of an instrument for observing classroom performance. In the course of developing norms for this instrument, using a sample of 1223 teachers representing 17 elementary schools, 9 middle, and 14 high schools

in 13 Florida counties, we found that the majority of teachers regularly use several of the 39 indicators in their daily classes. In fact, 75% use 12 or more in a lesson. The scores of teachers in the sample did not vary significantly across subjects, types of classroom facilities, or teacher characteristics (degrees, experience, sex, race). Nor did student characteristics such as socioeconomic status and exceptionality bias teachers' scores. Despite the fact that the forms of instruction -- seatwork and lecture-discussion -- affected the frequency with which the indicators were performed, the generic nature of the indicators across all forms of teaching appears strongly supported.

Content-Specific Teaching Performances

Another area of research is the pedagogy of school subjects. Over 300 courses are offered by the public schools. However, they can be grouped into a few subjects such as language, science, mathematics, social sciences, arts, and vocational studies. Each of these requires certain techniques unique to its subject matter. How the content is handled, how it is sequenced, how its more difficult elements are recognized, and how they are treated to maximize clarity vary from one subject to another. To teach skill in baseball is quite different from teaching skill in arithmetic. Of course, teaching in either case requires explanations, diagnoses, remediation, and practice. But these operations differ from subject to subject. To perform them the teacher must know the content, but subject matter knowledge is not sufficient. To know the subject matter is not to know how to perform these operations just as to know anatomy and physiology is not to

know how to remove a gall bladder. We know how to perform these teaching operations in the subject of reading from a long line of research workers beginning with Thorndike, Gates, Gray just as physicians know how to remove a gall bladder from the research of Halsted and others.

Knowledge of how to teach reading, arithmetic, grammar, natural science, and foreign language is fairly extensive. But the same cannot be said of social science and the arts. Furthermore, the amount of research on the pedagogy of subjects at advanced levels is scarce. However, neither space nor time allows a review of research on the pedagogy of subjects, even were I capable of doing so. But perhaps an example or two can give an inkling of the research.

Over half a century ago Thorndike found that number combinations were not equally difficult to learn; for example, 2+3, 4-3, and 2X2 are easier to learn than 16-7, 7+9, and 6X8 (Thorndike, 1922; Clapp, 1924). He also found that textbooks provide more exercises for easier combinations than for more difficult ones. Today researchers study more complex problems. For example, the story problem in mathematics is a stumbling block for many students. Young students are often unable to translate a story problem into an equation. Recent research suggests that a particular sequence for teaching young students to translate story problems into mathematical expressions is effective, especially with low achieving students (Darch, et al. 1984). Another question is how to teach estimation skills. Student use of calculators makes these skills useful as a check against error. How to teach estimating skills is being studied with promising results (Treadgill-Sower, 1984).

The pedagogy of reading, like mathematics, has been an area of research throughout the last 75 years. The research results are too volumninous to review here. Some of the persistent problems focus on word recognition and comprehension. The goal in word recognition is to increase the ability of students to expand their vocabulary by themselves. Types of comprehension and ways of increasing comprehension skills have been extensively investigated. Recent studies (Cook and Mayer, 1983) have investigated cognitive processes in reading comprehension. These studies are beginning to tell us how students use their prior knowledge and sense of prose structure in understanding the printed page.

Theoretical Pedagogy

The teaching and management behaviors I have discussed appear simple. In a recent conversation with a former colleague he said, "Surely you do not intend that these behaviors be taught to teachers; they are too easy." If you are of that opinion too, I invite you to consider the behavior of an attorney as he or she selects members of a jury or questions a witness, or consider a physician as he or she gives you an annual checkup. Once I observed an attorney as he questioned a panel for jury duty and I have noted the performance of more than one physician as I was being examined. What they do is simple. The attorney and the physician both ask questions and gather information. The physician asks, have I had this and that; he moves a stethoscope over my back and chest as he asks me to breathe deeply; he presses my belly firmly especially about the liver; he bends my legs at the knees and raises them at the hips, and scratches the bottom of my feet with

a metal object. He has technicians make tests and he reads graphs and charts. What can be simpler? Where is the mystery in all that?

Now, perhaps someone is thinking, "Yes, but what the physician or attorney is doing is more than these behaviors that you observed. What goes on in his or her head must be included in what the physician or the attorney does." Surely, I agree. But what of the teacher? Does not something go on in the teacher's head, too, as he or she performs in the classroom? Now, what goes on in the teacher's mind, like the physician or any other professional, depends upon his or her store of theoretical knowledge. That fact introduces us to the third element of the knowledge base of teacher education -- theoretical pedagogy.

Theoretical pedagogy consists of concepts and principles about human development, conditions of learning, and the relations among social variables. Its knowledge is extensive and I cannot review it here. But it is important to note its function. Theoretical knowledge is explanatory rather than prescriptive (Smith, et al. 1980). Its function is to render pedagogical practices intelligible, to account for their effects, and to elucidate the context wherein teaching occurs.

Theoretical pedagogy includes principles such as these 1) If a person is prevented from gratifying certain impulses and desires, that person's behavior will regress to a primitive level; and 2) If the status of an occupation is high, those who enter it are more likely to do so voluntarily and to be more stable in their occupational choice. Now, a teacher can use such principles to interpret his own performance or the behavior of students.

For example, fragmentation incites students to misbehave. If a teacher knows this fact and eliminates fragmentation from his or her performance, classroom disorder will be reduced. But the teacher may not know why the reduction occurs. To explain this is to take recourse to the principle of frustration and regression. Fragmentation impedes the movement of the student into the next activity and thus induces frustration. Misconduct then is a response to the frustration.

One of the most serious defects in the preparation of teachers is the failure to recognize that theoretical studies cannot function prescriptively in the work of the teacher. It is too much to expect teachers to derive classroom practices from the principles of psychology, sociology, or any other theoretical subject. These principles may yield ideas for classroom practice that the researcher can formulate and test, and if such hunches turn out under testing to be effective treatments, they can then be used by the classroom teacher. But thus far, the number of effective classroom procedures and techniques derived from theoretical propositions is rather small when compared to the stock of skills at the command of the highly trained teacher. However, developments along this line are beginning to turn up in increasing numbers.

If what has just been said has any validity, pedagogical psychology and sociology should be taught as explanatory subjects. This means, among other things, that as far as possible theoretical principles should be taught in such a way as to enable the practitioner to understand why a given practice is effective and to comprehend the context wherein that practice occurs.

Research and Reform

As I close, I want to say a few words about research and reform. Periodically American society experiences a peculiar phenomenon -- an overwhelming drive, almost a frenzy, for school reform. A few prominent citizens become anxious about the quality of schooling and express themselves in loud complaints about teachers, teaching, soft pedagogy, soft curriculum, or whatever. These movements quickly lose their drive after a few changes are introduced -- courses modified, methods refurbished, course requirements altered, laws enacted. Each begins with a big bang and ends about where it began.

Let me count these reform movements. There was the 1890's when Rice's survey of 30 schools filled the pages of the Forum with ringing criticism of the school's deadening effects. In 1909, only two decades later, Ayres published his Sage Foundation study that analyzed retardation and elimination and set off a decade of efforts to cut deadwood from the curriculum. Then in the latter part of the 1920's Everett Dean Martin and Albert J. Nock, along with others, raised their voices against the schools, claiming that standards of the mediocre and inferior had become the standards for the most fit. And who does not remember the 1950's when the nation was stirred by the complaints of Arthur Bestor and Admiral Rickover that our schools had been reduced to wastelands and that science and mathematics were being sacrificed to the interests of soft pedagogy and educationist. Then in the '60's we were told that Johnny not only knew no math or science but couldn't even read. And today the nation is at peril again.

Why have all these complaints, all the proposals for school improvement, and all the efforts by each generation to reshape the schools led to further complaints and further efforts by the next generation? I do not know the answer to this question. But let me speculate. Could the answer be that we really do not know whether the schools are better or worse and that this uncertainty periodically skills over into a seizure of anxiety? Could the answer be that we have never reconciled ourselves to mass education and really do not want to cope with it? Could it be that the educational establishment is so loosely jointed and so intimidating in size that no nationwide change can be initiated and sustained? Could the answer be that the reformers fly by the seat of their pants, knowing neither what changes to make nor how to make them? Could the answer be that the profession has been, and continues to be, poorly prepared, locked into a static system of professional mobility, and denied ample return on investment in preparation? Could the answer be that the knowledge base for school improvement is ignored, nether used nor its production adequately supported? It is unlikely that any one of these is in itself an answer, but perhaps each is in some sense relevant.

While I have no answer to the question, I do wish to make one or two observations. First, almost all complaints against the schools include an attack on colleges of pedagogy, attacks that more often than not urge elimination of these colleges. This is indeed peculiar, particularly in a nation committed to mass education where the reality is not Mark Hopkins and a student on a log but a teacher in a room faced by 30 or more students who are there by government design and who harbor more variations in interest, capa-

city, previous learnings, and personal and family problems than anyone in this audience can imagine. Secondly, I note that the quality of service rendered by any profession is directly proportional to the extent of its knowledge base and that that base depends upon how robust the profession's research is. That state and federal governments, extolling the virtues of schooling to the nation and the state, should at the same time be niggardly in support of pedagogical research is to me queer and disconcerting.

One can hope that in the current round of complaints and efforts to reform that we have learned something useful from previous endeavors and that our efforts this time will not become another tour de force. We appear to be on the right course when we focus on the reconstruction of pedagogical education and the progressive utilization and expansion of its knowledge base. How else can our ideal of mass education be realized?

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